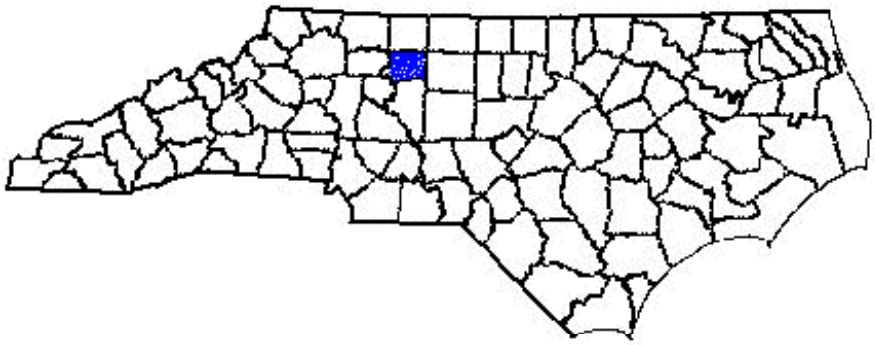
ANNUAL REPORT FOR 2002



Friedburg Marsh Mitigation Site
Forsyth County
Project N0. 6.628001T
TIP No. R-2247

Prepared By:
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North Carolina Department of Transportation
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SUMMARY

The following report summarizes the monitoring activities that have occurred in 2002 at the Friedburg Marsh mitigation site. Friedburg Marsh was constructed in winter of 1999 and spring of 2000. Monitoring activities in 2002 represent the second year of monitoring following construction. The site must demonstrate hydrologic success during the five-year monitoring period.

Friedburg Marsh is composed of existing wetlands, upland buffer areas, wetland restoration areas, and wetland creation areas. A total of 12 groundwater monitoring gauges are installed in the site. There was no planting of trees or herbaceous species at Friedburg, so vegetation monitoring is not required. Qualitative visual observations are taken for the existing vegetation.

Hydrologic data indicate that all of the Friedburg Marsh gauge locations met the hydrology success criteria of 5.0% during the 2002 growing-season. Periods of inundation/saturation lasted from 6.1 to 26.3 percent of the growing season.

The daily rainfall depicted on the well data graphs is obtained from the NC Climate Office, Winston-Salem weather station. The historical rainfall data used in the 30-70 graph was also obtained from the NC Climate Office, Winston-Salem weather station.

Monitoring will continue for the 2003-growing season.

1.0 INTRODUCTION

1.1 Project Description

The Friedburg Marsh mitigation site, located in southern Forsyth County (Figure 1), is the easternmost known location (in North Carolina) for the bog turtle (*Clemmys muhlenbergii*). The southern population of bog turtle is federally listed as a Threatened Species due to Similarity of Appearance. Due to the diverse wetland communities at this marsh, the Piedmont Land Conservancy and the North Carolina Natural Heritage Program consider the site a regionally significant natural site. The Friedburg Marsh Mitigation Plan calls for the preservation and enhancement of the existing wetland habitat as well as restoration and creation of additional bog turtle habitat.

The Friedburg Marsh mitigation site consists of existing wetlands (3.8 acres), upland buffer (38 acres), and wetland restoration/creation areas (5.7 acres). The restoration/creation areas were constructed in 1999/2000 to increase hydrology and improve bog turtle habitat. Construction activities involved filling ditches, constructing ditch plugs, grading to reflect groundwater profiles, removing invasive woody vegetation, and installing a new outlet for the upper pond area. No vegetation planting was conducted.

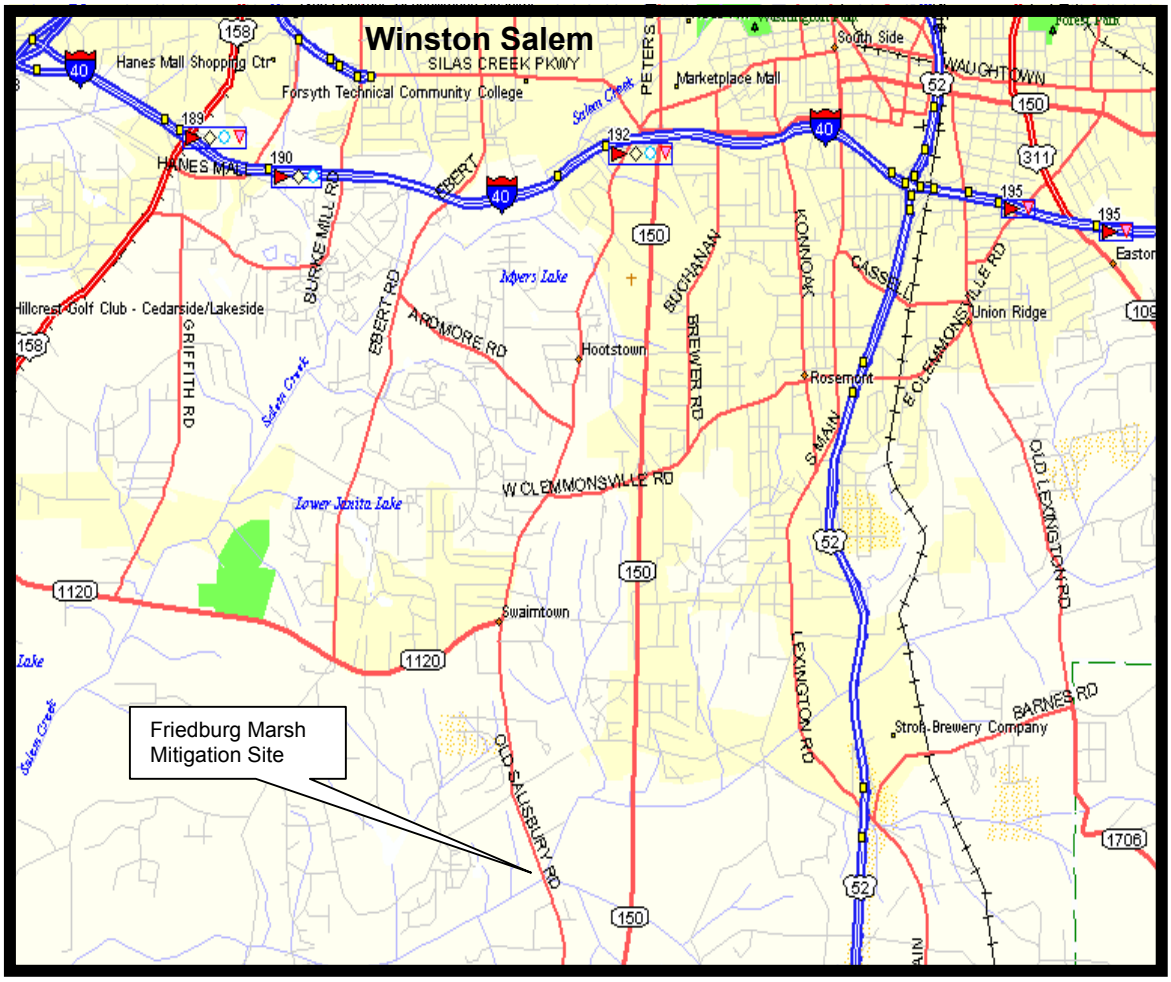
Friedburg Marsh is located in the Muddy Creek portion of the Yadkin River basin. This site was created to offset wetland impacts associated with the Winston-Salem Outer Loop (TIP No. R-2247).

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic criteria must be met during the five years of monitoring. The following report details the results of hydrologic monitoring during the year 2002 at the Friedburg Marsh mitigation site.

Year 2002 is the second year of monitoring following site development in 2000. Included in this report are analyses of hydrology and vegetation monitoring results as well as local climate conditions throughout the growing season.

Figure 1. Friedburg Marsh Vicinity Map



1.3 Project History

May 1997	Feasibility Study Conducted
November 1997	Site purchased by NCDOT, Initial Monitoring wells installed.
1999	Mitigation Plan developed
Winter-Spring 2000	Grading and Construction
March 2000	Additional monitoring wells installed
March-November 2001	Hydrology Monitoring (Year 1)
July 2001	Vegetation Monitoring (Year 1)
March-November 2002	Hydrology Monitoring (Year 2)
August 2002	Vegetation Monitoring (Year 2)

2.0 HYDROLOGY

2.1 Success Criteria

The success criteria for hydrology states that wetland hydrology will be established when water inundates or saturates (within 12 inches of the surface) the mitigation area consecutively for 5.0 percent of the growing season.

The growing season in Forsyth County begins March 28 and ends November 10 (228 days). These dates correspond to a 50 percent probability that temperatures will drop to 28F or lower after March 28 and before 10 November (Soil Survey of Forsyth County, 1976, p63). The 5.0 percent of the growing season stipulated in the success criteria translate to 12 consecutive days of inundation or saturation.

Local rainfall must be within normal limits to qualify hydrology as successful.

2.2 Hydrologic Description

RDS WL40 and WL20 units record all groundwater and surface water data (Figure 2). Depth to groundwater is recorded daily. The RDS units are downloaded in the field on a monthly basis. In November 1997 six groundwater gauges were installed at Friedburg Marsh to monitor pre-construction hydrology and develop a mitigation plan, of which one gauge location (S2C9913) was installed to record surface water and groundwater depths. Following construction six additional groundwater gauges were installed, of which one gauge location (2139BB) was installed to record surface water and groundwater depths.

2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was then converted into a percentage of the 228 day growing season (March 28 – November 10). The results are presented in Table 1 and Figure 3.

Appendix A contains a plot of the groundwater depth for each gauge. The maximum number of consecutive days and percentage of growing season of inundation/saturation is noted on each plot. The individual precipitation events, shown on the monitoring gauge graphs as bars, represent data provided by the NC Climate Office.

Figure 3 represents a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Gauges highlighted in red show hydrology between 8% and 12.5% of the season, while those in green indicate hydrology between 5% and 8% of the season. Gauges highlighted in black indicate no wetland hydrology (less than 5% of the growing season).

During the summer of 2002, a meeting was held with DOT Division personnel to discuss the leaking riser in the old pond. Due to the exceptionally dry summer it could not be determined if the riser was leaking. The riser will be monitored this winter and repaired if a leak is discovered.

Figure 2. Friedburg Marsh Monitoring Gauge Location

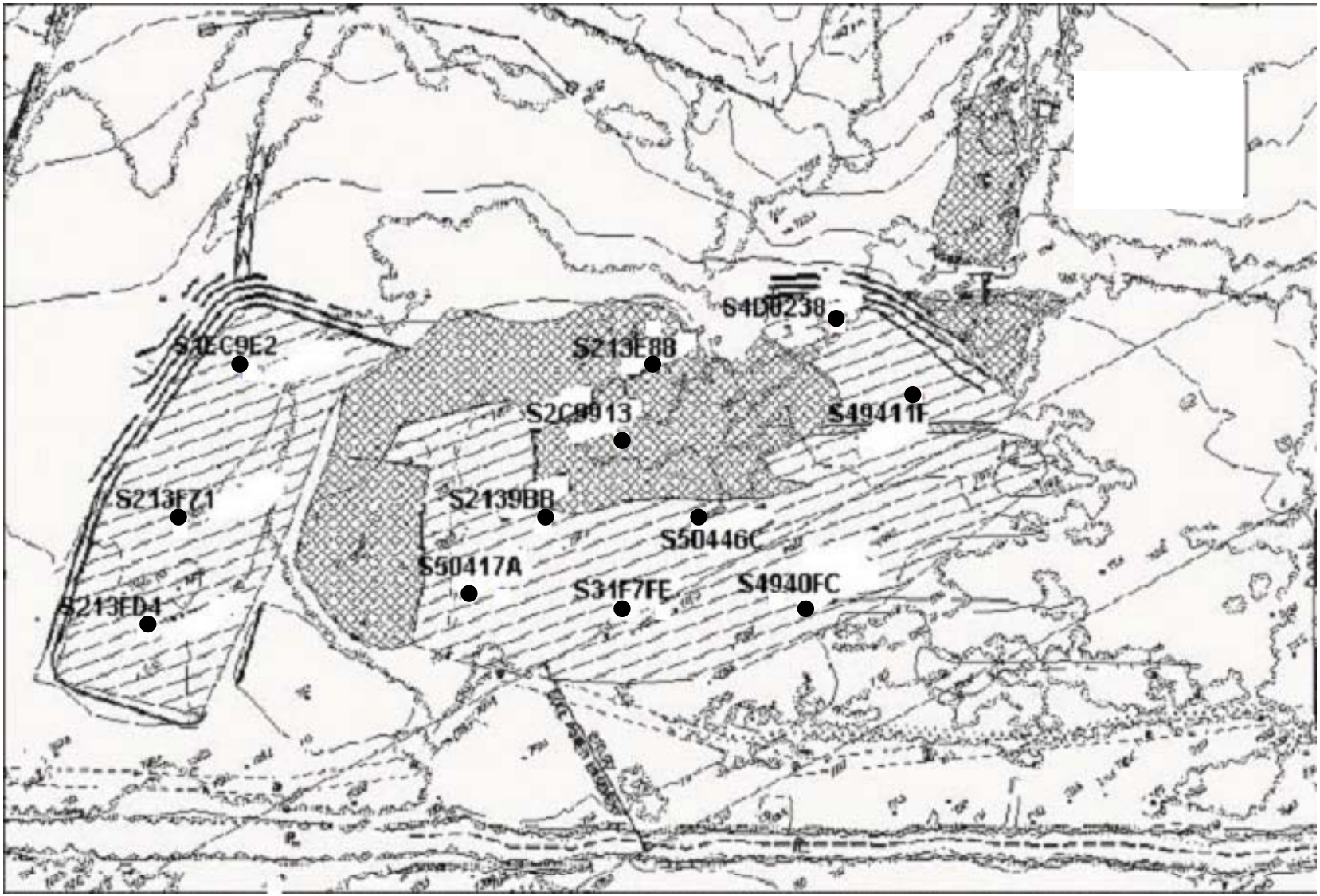


Table 1. Hydrologic Monitoring: Friedburg Marsh Mitigation Site

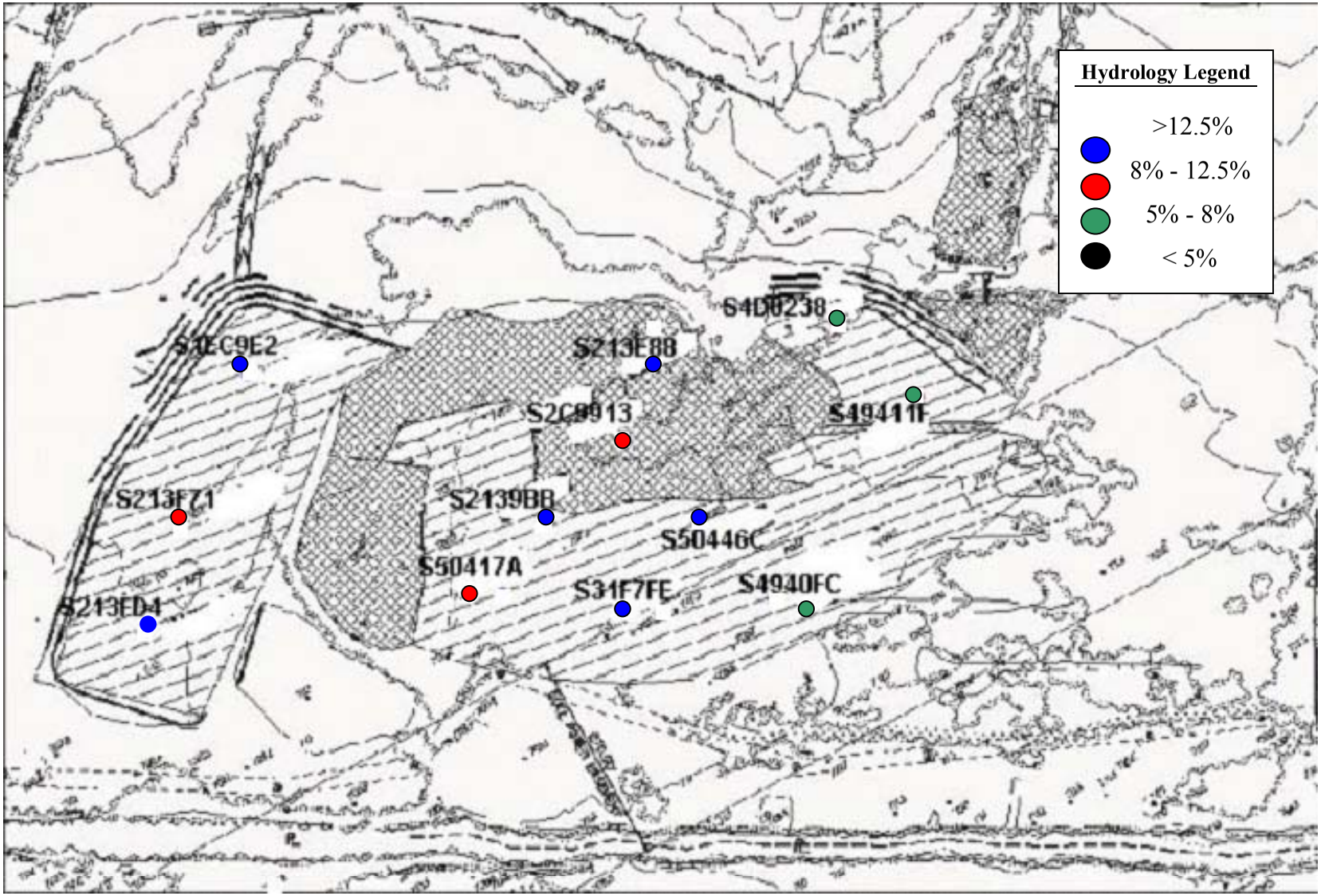
Monitoring Gauge	<5%	5% - 8%	8% - 12.5%	>12.5%	Actual %	Success Dates
S2C9913			✓		10.1	March 28-April 19 Oct 29-Nov 10
S213FD4				✓	13.2	Oct 12-Nov 13
S213F71			✓		12.3	March 28-April 11 Oct 14-Nov 13
S1EC9E2				✓	26.3	March 28-May 26 Aug 26-Sept 8 Sept 15-Oct 7 Oct 11-Nov 13
S213E88				✓	25.4	March 28-May 24 Oct 16-Nov 13
S2139BB				✓	24.6	March 28-May 22 Oct 12-Nov 13
S50446C				✓	18.7	March 28-May 9 Oct 16-Nov 13
S4940FC		✓			5.7	Oct 29-Nov 13
S31F7FE				✓	14.5	March 28-April 29 Oct 16-Nov 13
S4D0238		✓			6.1	March 28-April 10 Oct 29-Nov 13
S49411F		✓			5.3	Oct 30-Nov 13
S50417A			✓		11.8	Oct 15-Nov 13

Specific Gauge Problems:

- **S2139BB**: The gauge experienced data loss (August 21 to September 30) due to gauge malfunction.
- **S50446C:** The gauge stopped recording data (June 26-September 30), and was replaced.
- **S49411F:** The gauges battery was replaced and lost data from (April 18-July 12).
- **S50417A:** The gauge experienced malfunction from the beginning of the growing season to July 12, and (August 21-September 30).

Hydrologic data indicates that the site meets the hydrologic criteria. All monitoring gauge locations were continuously inundated or saturated for more than 5 percent (12 days) of the growing season.

Figure 3. Friedburg Marsh 2002 Hydrologic Results


Hydrology Legend
>12.5%
8% - 12.5%
5% - 8%
< 5%
S4D0238
S213E88
S2C8913
S49411F
S213FZ1
S2139BB
S50446C
S50417A
S31F7FE
S4940FC
S213ED4

2.3.2 Climatic Data

Figure 4 represents an examination of year 2002 rainfall in comparison with historical rainfall data in order to determine whether 2002 was “average” in terms of precipitation. The historical rainfall data was collected from 1971 through 2002 (30 years). All rainfall data was collected from the NC Climate Office, Winston Salem weather station.

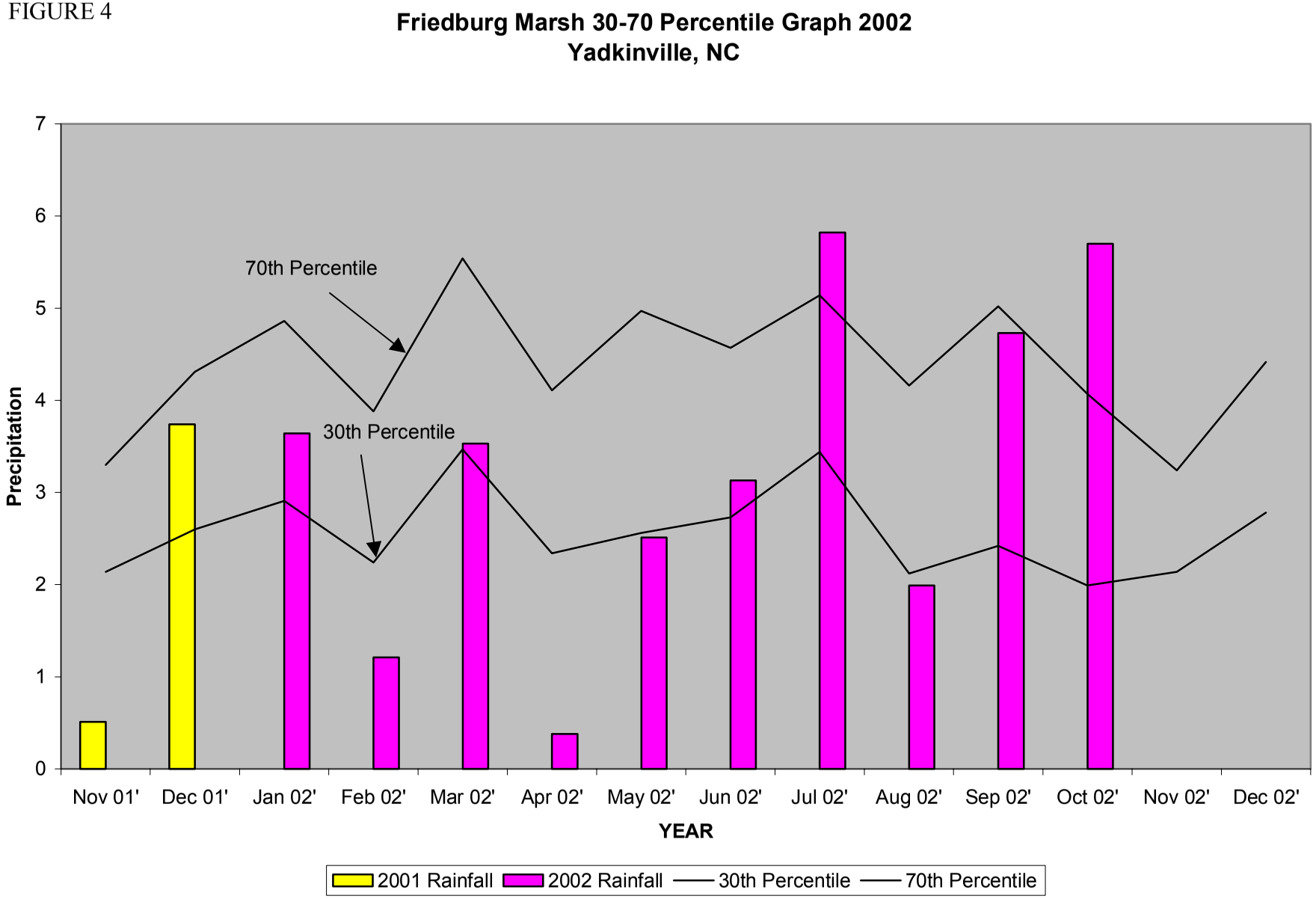
The monthly rainfall totals for the period of November 2001 through October 2002 are shown in Figure 4. The data for this period shows rainfall within average limits for four months (January, March, June, and September) and below average limits for four months (February, April, May, and August). July and October experienced above average rainfall.

2.4 Conclusions

The year 2002 is the second growing season that the monitoring gauges have been in place post construction. All Friedburg Marsh gauge locations exceeded the five percent hydroperiod criteria. Gauge locations with shortened hydroperiods (below 12.5 percent) were located in creation areas where compacted soil may be preventing infiltration. The installation of surface water gauges in these areas may demonstrate that inundation is occurring.

Hydrologic monitoring of the Friedburg Marsh mitigation site will continue for the 2003-growing season.

FIGURE 4


Friedburg Marsh 30-70 Percentile Graph 2002
Yadkinville, NC
Precipitation
0
1
2
3
4
5
6
7
70th Percentile
30th Percentile
Nov 01'
Dec 01'
Jan 02'
Feb 02'
Mar 02'
Apr 02'
May 02'
Jun 02'
Jul 02'
Aug 02'
Sep 02'
Oct 02'
Nov 02'
Dec 02'
YEAR
2001 Rainfall
2002 Rainfall
30th Percentile
70th Percentile

3.0 VEGETATION: FRIEDBURG MARSH (YEAR 2 MONITORING)

3.1 Results of Vegetation Monitoring

No planting of trees or herbaceous species was undertaken as part of the Friedburg Marsh mitigation. As a result, no quantitative vegetation monitoring is required. Qualitative observations of common species have been made in conjunction with hydrologic monitoring.

The following species are found in the creation/restoration area, Spike rush, pickerelweed, bulrush, *Juncus* sp., alder, cattail, poplar, and green ash are the more wet tolerant species. Also found were; foxtail, broomsedge, beggar's ticks, barnyard grass, goldenrod, sweetgum, and multi-flora rose. The presence of these species in these areas has not affected the overall quality of the bog turtle habitat at Friedburg Marsh.

3.2 Conclusions

The vegetation in the restoration/creation areas is dominated by wetland plant species and includes a variety of other species as well.

NCDOT will be coordinating with Dennis Herman of the NC Museum of Natural History this spring. His recommendations on vegetation enhancement will be implemented by NCDOT.

NCDOT will continue visual vegetation monitoring at the Friedburg Marsh Mitigation Site.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

- All groundwater gauges in Friedburg Marsh met the hydrologic success criteria.
- The riser and dam of the old pond will be monitored this winter and repaired if necessary.
- The vegetation in the restoration/creation areas is dominated by wetland plant species and includes a variety of other species as well.
- NCDOT will continue to monitor the site for hydrologic success.
- NCDOT will be coordinating with Dennis Herman of the NC Museum of Natural History this spring. His recommendations on vegetation enhancement will be implemented by NCDOT.

APPENDIX A

DEPTH TO GROUNDWATER PLOTS

APPENDIX B

Site Photos

Friedburg

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

2002